The Emu

Official Organ of the Royal Australasian Ornithologists' Union.

"Birds of a feather."

VOL. XII.] 1ST APRIL, 1913. [PART 4.

On the Comparative Osteology of Cereopsis novæ-hollandiæ.

BY R. W. SHUFELDT, M.D., WASHINGTON, D.C.

THERE is at present, so far as I am aware, no complete account of the skeleton of the Australian Goose described by Latham as *Cereopsis novæ-hollandiæ*, wherein its characters have been compared with those to be found in the skeletons of other species of Geese. This extraordinary fowl is now on the road to extinction, and it is important that we should possess a reliable account of its osteology. Eyton, in his Supplement to his "Osteologia Avium," presents the right lateral view of a more or less complete skeleton of an adult specimen of *Cereopsis* (unnumbered); but it is merely a sketchy affair, drawn by Mr. G. Scharf, and of little value beyond giving a general notion of the articulated skeleton of a specimen of this species.

What Eyton has to say, in his general work, with respect to the osteology of *Cereopsis novæ-hollandiæ*, is very little, more or less unscientific, and, in some respects, quite incorrect. What he says would lead one to suspect that *Cereopsis* was like *Plectropterus gambensis* in the matter of its skeletology, which, as we know, is not so.*

Sharpe, in his "Hand-list of Birds," places *Plectropterus* and *Cereopsis* in two distinct sub-families (*Plectropterinæ* and *Cereopsinæ*, vol. i., pp. 208 and 210), and the morphology of the two forms stands for the correctness of such a taxonomical arrangement.

My ability to furnish an account of the osteology of *Cereopsis* is entirely due to the courtesy of the United States National Museum, and to Dr. Charles W. Richmond, of the Division of Birds of that institution, for the loan of not only the necessary material for the purpose, but a large series of other skeletons of Ducks, Geese, and Swans, wherewith to make a comparative study of this remarkable Australian anserine. The material in question consists of a complete skeleton of *Cereopsis novæ-hollandiæ*

---

* Eyton, T. C., "Osteologia Avium; or, A Sketch of the Osteology of Birds," Lond., 1867, p. 204. Plate in the Supplement (1869), where, though it is unnumbered, it is No. 2.

(No. 19,711, Coll. U.S. Nat. Mus.), and some of the vertebræ, the femora, hyoid, and upper part of the trachea of another adult specimen (No. 19,734, Coll. U.S. Nat. Mus.) Then there are at hand more or less complete skulls and skeletons of a large number of Ducks; of species of Mergansers; of *Branta*, *Olor*, *Anser*, *Chen*, *Chloëphaga* (*hybrida* and *poliocephala*), *Cygnus*, *Hymenolæmus malacorhynchus*, *Chenonetta jubata*, *Dendrocygna* (two species), *Tachyeres cinereus*, and others.

SKELETON OF CEREOPSIS NOVÆ-HOLLANDIÆ.

The Skull.—There is no existing form of Goose that I know anything of which possesses a skull at all resembling that part of the skeleton in *Cereopsis*. No Goose in the avifauna of North America has one at all like it; while in South America the skulls of some of the Geese which have been relegated to the genus *Chloëphaga* come nearer to it, but even in their case the similarity is by no means at all close. (Fig. 1, Plate XXVIII., fig. 18, Plate XXX., and fig. 19, Plate XXXI.)

For the size of the bird, the skull in *Cereopsis* is small, while, at the same time, it is comparatively broad and massive. When viewed from above, it is to be observed that the vault of the cranium is smooth and rounded, with barely any evidence of the presence of a mid-longitudinal furrow. This also obtains in *Chloëphaga hybrida*, but not so in *Chloëphaga poliocephala*, in which Goose the median furrow is more pronounced. In *Chenonetta jubata*, and, to a somewhat less degree, in *Hymenolæmus malacorhynchus*, while the vault is smooth and rounded upon this view of the cranium, there are likewise hemi-ellipsoidal elevations present, corresponding to concavities within for the accommodation of the cerebral lobes. (Fig. 3, Plate XXVIII., fig. 12, Plate XXIX., and figs. 17, 18, Plate XXX.)

One of the most remarkable characters on the upper view of the skull in *Cereopsis* is the presence of the very extensive "supra-orbital depressions." These are rather shallow, but very wide, and extend well forwards and backwards. For some distance, mesially, they are separated from each other by about 2 millimetres—the separating surface presenting no elevation, but lies in the same plane with the general superficies of the top of the skull. (Fig. 18, Plate XXX.)

Chloëphaga hybrida possesses the most elaborate supra-orbital depressions. They are more profoundly sculpt and extensive in this species than they are in representatives of other groups of birds, where they are a common character. In this Goose they are not only deep, with rugose surfaces, but they meet in the middle line for over a centimetre and a half. They sweep round to the parieto-frontal region posteriorly, while anteriorly they are most profoundly impressed to a point on either side beyond the frontal insertion, or articulation, of the lacrymal bone. The free edge they create anteriorly is usually serrated and jagged, being concaved posteriorly on either side of the middle line of the skull.*

Quite different from *Chloëphaga hybrida* is *Chloëphaga poliocephala* in this respect, for in it the supra-orbital depressions are shallow, rather far apart, and little more than narrow trimmings of the supra-orbital peripheral margins, as far forwards as the articulation of a lacrymal bone on either side. (Fig. 4, Pl. XXVIII.) These depressions are still less conspicuous in species of the genera *Anser*, *Chen*, and *Branta*, while in *C. jubata* they are slightly more evident, but very narrow. *Hymenolæmus malacorhynchus* has them not at all, and *Tachyeres cinereus* has them extensive, but very shallow, though in this bird they give rise to an evident mesial crest, extending from the frontal region backward to the parietal.

None of the foregoing among the Geese possesses any movability to the "cranio-facial hinge." It is absolutely rigid in all save *Chloëphaga hybrida*, in which species, in the case of the skull before me, it is perfect (No. 1,820, Coll. U.S. Nat. Mus.). Nevertheless, the transverse line of the suture in this region usually persists throughout life in all these forms, and in most of them, in the middle line in this region, we may discern the sutural traces of the naso-frontal processes of the premaxillaries. Exceptions to this are to be seen in *Branta c. hutchinsi* (No. 7,357, Coll. U.S. Nat. Mus.), and they are very faint in *Cereopsis*. (Fig. 18, Plate XXX.)

Taken in its entirety, the *superior mandibular* portion of the skull exhibits a very considerable amount of variation in the several genera of Geese to which I have referred in the foregoing paragraphs. As may be observed by examining the several figures on the plates, in *Cereopsis novæ-hollandiæ* this facial part of the cranium is relatively short, while, at the same time, it is markedly broad and deep. Either external *narial aperture* is broadly elliptical and of great size—so large, indeed, that the naso-premaxillary part of the superior mandible above them is mounded up, more or less convex, externally, and is unusually wide, transversely, between these narial apertures. This elevated portion slopes down in front, more or less abruptly, a short distance behind the broadly-rounded termination of the superior mandible (fig. 1, Plate XXVIII.), the terminal area, superiorly, showing the usual scattered group of nutrient foramina.

Laterally, the tomial margins are both sharp and deep, and the osseous roof of the mouth between them is profoundly concaved. Mesially, this latter may exhibit a small, slit-like foramen, which, in some Geese, is of elliptical outline and of great size, as in *Tachyeres cinereus*. Where small, the roof of the mouth is nearly entirely completed in bone; but where it is large, this antero-palatal portion of the cranium is correspondingly lacking in osseous completion, and so more or less weak in structure.

---

* Shufeldt, R. W., "Contribution to the Study of the 'Tree-Ducks' of the genus *Dendrocygna*." Plate XI., fig. 35 (in MS.) This memoir, when published, will, on thirty-five plates, give figures of skulls and other parts of the skeleton of a large number of the *Anseres* from various regions of the world.

Cereopsis possesses only a partial *nasal septum* performed in bone, and this, in the adult, is confined to the posterior rhinal space, between the nasals, and somewhat anterior to them.

As will be noted from an examination of fig. 23, Pl. XXXII., the facial part of the cranium in *Tachyeres cinereus* has an aspect more after the order of what we see in the skull of an average Goose than has the corresponding cranial region in *Cereopsis*, for in *Tachyeres* the line of the culmen—from the concave fronto-cranial area, situated mesially between the long, forward-projecting portions of the lacrymals to the anterior extremity of the superior mandible—is very gently concaved, as it is in most species of *Anser* and *Branta*. *Tachyeres*, too, has large, elliptical external narial openings, with a complete absence of any osseous nasal septum. The osseous tomia are thin and very sharp-edged, while the sides of the mandibular walls are deep in this species, and the distance between them considerable, thus rendering the concavity formed by the bones of this upper mandible on its lower side unusually spacious.

Chen hyperboreus has an osseous superior mandible very different from this, and even more so as compared with that part of the cranium in *Cereopsis*. *Chen* has this part of its skull—which is in keeping with all the rest of it—thick and strong. From its basal portion to its apex it tapers considerably to the rounded extremity, and the line of the blunt edge of either osseous tomium is convex upwards for its entire length. The osseous *nasal septum* is imperfect in this Goose, and what there is of it is situated posteriorly above the maxillo-palatine mass. Either external narial aperture is large and subelliptical, and the distance between them, superiorly, narrow at its middle part. The concavity on the under side of the superior mandible is shallow, and the surface roughened. The mesial foramen occurring there in so many of the *Anseres* is usually very small in this genus. Between the apex and the ending of the maxillo-palatine mass posteriorly, in the mid-longitudinal line, there is a long, deep furrow; while on either side of this, between it and the tomial border, there is a chain of roughened tubercles. Each commences where the palatine of the same side is inserted, and terminates at a point about half-way to the apex, being largest posteriorly, and becoming gradually smaller to their anterior disappearance. No other Goose known to me possesses these, and there is not the slightest evidence of their presence either in *Anser* or *Branta*.

On either side the *infero-posterior process of the premaxillary*—by some called the *nasal process* of that bone—is produced backward in the skulls of many species of Geese, but not in all. It is conspicuously so in *Tachyeres*, *Anser*, *Branta*, *Chen*, *Hymenolæmus*, and *Chloëphaga poliocephala*, but much less so in *Chloëphaga* *hybrida*, to be entirely absent in *Cereopsis*, where that apophysis is completely rounded off.

Hymenolæmus malacorhynchus has a thin and fragile superior osseous mandible—elongate, with comparatively small external narial apertures; sharp tomia; deeply concaved on its under side, and with its distal end squared rather than rounded as in the Geese. (Fig. 3, Plate XXVIII., fig. 17, Plate XXX., fig. 20, Plate XXXI.)

Viewing the skull of *Cereopsis* on its posterior aspect, we are to note that the usual landmarks, often found there in the avian cranium, are but feebly pronounced. The entire area is more or less globular or rounded, with the *occipital ridge* and the *crotaphyte fossæ* but faintly defined. The *supra-occipital prominence* hardly exists as an independent elevation, while the foramen on either side of it is extremely, or at least very unusually, small. Of good size, the *foramen magnum* is subcordate in outline, and the condyle for the atlas notched on its upper side in the middle. *Anser albifrons gambeli* has all the characters at the back of its cranium in complete agreement with what I have just given for *Cereopsis*. To a large extent, this applies to *Chen hyperboreus*; but in the genus *Chen* the occipital ridge may be somewhat better defined, though it is not always so. In *Branta* this is invariably the case, while the *occipital prominence* is far more conspicuous in members of that genus, especially in *Branta canadensis*.

In *Tachyeres cinereus* the posterior aspect of the cranium differs, in each and every character, from what we meet with in *Cereopsis*; for in the former the *crotaphyte fossæ* are deep and sharply defined; the *occipital ridge* prominently produced; the *occipital prominence* much elevated, and the large, vertically elliptical foramen on either side of it seems, with respect to its presence and absence, to depend upon age in this Goose, as it may in other genera of this group. In the skull of one individual of this species at hand (No. 1,819, Coll. U.S. Nat. Mus.) these foramina are almost entirely absorbed, being quite minute, with the prominence standing between them of slight elevation. On the other hand, in another skull they are, as I have stated above, large and elliptical in outline, with the *supra-occipital prominence* much better defined (No. 1,818, Coll. U.S. Nat. Mus.) (Fig. 23, Pl. XXXII.) In both these skulls the *foramen magnum* is somewhat acutely cordate in outline, the apex being above. This is likewise its form in *Hymenolæmus malacorhynchus*—that is, in the skull at hand, wherein, too, the shallow *crotaphyte fossæ* are extensive, especially below.

Regarding the skull of *Cereopsis novæ-hollandiæ* in lateral view, we observe that the *aural aperture* or *external auditory meatus* is large and open, with its periphery of a subcircular outline (Fig. 1, Plate XXVIII.) A lengthy *sphenotic process* is developed, directed downward and forward, terminating in a free, truncate apex, at a distance of some 5 or 6 millimetres from the apex of the descending process of the lacrymal. So far as I am aware, these processes never meet each other to thoroughly co-ossify at their point of meeting, as they do in the Ducks of the genus *Dendrocygna*, where the sphenotic process and the lacrymal fuse together at their apical union, forming a complete osseous orbital ring, as in Parrots.

In *Chloëphaga hybrida* not only is the stout sphenotic process much lengthened, but the descending process of the lacrymal is considerably more so, and that to an extent to curve round toward the apex of the sphenotic, beneath the eye, and come within 2 or 3 millimetres of meeting with it at its apex. This is not nearly so much the case in *Chloëphaga poliocephala*, where quite an interval separates them. (Figs. 2 and 4, Plate XXVIII.) The interval between the apices in these processes is still greater in *Tachyeres cinereus*, in which species the big lacrymal bone has its free descending process ending in a circular expanded tip, which apparently has no inclination for backward extension. This is equally true for *Hymenolæmus malacorhynchus*. In the genera *Chen* and *Anser* the two processes in question are far separated, and, instead of there being any inclination for them to meet and fuse together, the end of the descending process of the lacrymal is frequently directed forwards (*Chen hyperboreus*).

In *Branta canadensis* the sphenotic process is large and very long; but it exhibits no inclination to meet the lacrymal bone, the apex of the descending portion of which is expanded and sometimes bifid, or even trifid (No. 17,980, Coll. U.S. Nat. Mus.)

All anserine birds, in so far as my observations carry me, have the *lacrymal bone* very large, and to this rule *Cereopsis* forms no exception. Here it thoroughly co-ossifies with all the surrounding bones with which it comes in contact, as the frontal, the nasal, and, to a slight extent, mesially, with the thin, shell-like *pars plana*, which is thrown out against it from within.

In *Tachyeres cinereus*—one of the *Fuligilinæ* in which the pars plana in no way ossifies—the very large lacrymal is much compressed in the lateral direction, and its anterior extending process is conspicuously long, as of necessity it must be in order to reach the nasal of the same side, with which bone it usually articulates by an open suture.

There is likewise a very poorly developed *pars plana* in *Chloëphaga hybrida*—a species in which the upper portion of a lacrymal is enormous, being much compressed from side to side, and of a triangular outline. Both in *Chloëphaga hybrida* and *C. poliocephala* there is a pneumatic foramen present, at the antero-external aspect of the lacrymal at its lower part. It may also occur in other Geese, but is not so evident in them, while in *Branta canadensis* I do not find it at all.

Hymenolæmus malacorhynchus possesses a very considerable *pars plana*, it being a double, shell-like formation, completely separating the orbital cavity from the rhinal chambers. In *Anser a. gambeli* it is incomplete below, as it likewise is in *Branta* *c. hutchinsi*, while in *Chen hyperboreus* it may be entirely absent in the adult.

Usually, the *inter-orbital septum* is very completely ossified, as it is in *Cereopsis*, where it is thick, and the usual foramina for the exit of the nerves, at the back and lower part of the orbit, are exceptionally small and thoroughly individualized. (Fig. 1, Plate XXVIII.) In any of these wild Geese, so far as I have examined the skulls of them, if any vacuities exist in the mesial or posterior orbital walls, they occur in the upper or the posterior one, or both, and thus lead into the cranial cavity. This is the case in *Chen*, *Anser*, and *Branta* among the *Anserinæ*, also in *Hymenolæmus* among the *Merganettinæ*, and others.

The *infra-orbital* or *zygomatic bar* is a straight, slender rod in the skulls of all the species of Geese thus far referred to, including *Cereopsis*, as will be appreciated by a glance at figs. 1, 3, 4, and others shown on the plates. Anteriorly, it thoroughly fuses at its articulation with the several bones it meets, as the palatine, maxillo-palatine, nasal, and premaxillary.

Seen upon side view, the great spongy, osseous *maxillo-palatine* in *Cereopsis novæ-hollandiæ* rises above its articulation with the bones below, to articulate with the posterior border of the nasal, with the lacrymal, and, to some extent, with the premaxillary, thus quite shutting out from sight, on this view, the fellow of the opposite side, as well as any of the structures in the posterior part of the rhinal space. To a lesser extent this is likewise the case in *Branta canadensis*; but in this typical wild Goose the ascending plate of the *maxillo-palatine* is thin, and its spongy formation is not overlain with compact osseous tissue, as it is in *Cereopsis*. As a rule, it does not meet the lacrymal, but extensively fuses with the opposite maxillo-palatine, with the posterior border of the nasal, and with the upper surface of the palatine of the same side, thus forming the typical desmognathous arrangement which is characteristic of all the true *Anseres*. With respect to this arrangement, *Branta c. hutchinsi* agrees with *B. canadensis*, as do likewise representatives of the genera *Chen* and *Anser*. It is different, however, in *Tachyeres cinereus*, where it is situated low down, being concave internally, correspondingly convex externally, and thoroughly fused with the mesial surface of the nasal and the inner border of the palatine; and, while it comes extensively in contact with the maxillo-palatine of the opposite side, the suture generally remains ununited. The distal end of the vomer may or may not reach these maxillo-palatines in the middle line—generally not. So low down are the maxillo-palatines placed in the skull of this Duck of the Falklands that an extensive open space is left above them, admitting of a considerable view, from side to side, through the skull, above the vomer and below the fronto-lacrymal roof. (Fig. 23, Pl. XXXII.) In all this, *Hymenolæmus malacorhynchus* among the *Merganettinæ* essentially agrees, as will be seen by comparing the skull of that bird with others shown in the plates (figs. 3 and 23, &c.)

Wild Geese, of various genera, usually have the distal end of the *vomer* either firmly clasped by the united maxillo-palatines or else completely fused with them. As a rule, the upper border of the vomer is produced anteriorly as a delicate little spine, and it is this spine alone that sometimes is the part thus fixed. Occasionally, however, the distal end of the vomer is free, as it is in a skull of a *Chloëphaga hybrida* at hand (No. 1,820, Coll. U.S. Nat. Mus.); but this is by no means commonly the case.

Turning next to the basal view of the skull in *Cereopsis*, we are to note that the *basitemporal area* is unusually smooth, and devoid of any striking elevations or depressions. Anteriorly, at its termination, the openings to the Eustachian tubes are in plain sight, being unprotected by the usual underlying lip of bone, developed at the anterior apex of the basitemporal. What is more remarkable, the basitemporal in the skull at hand develops a thin sheath of bone, which spreads out over the basisphenoid, to extend forwards as far as the anterior endings of the facets for the pterygoids, between which latter, posteriorly, the aforesaid sheath is perforated by an elliptical foramen of some size, with its major axis in the median line. Such a formation has never been observed by me before in the skull of any bird. It is not repeated in any of the *Anatidæ* now under consideration.

In all anserine fowls the *quadrate* is a large and massive bone, and to this *Cereopsis* forms no exception. Upon either one, the two articular facets for articulation with the mandible are elongo-ellipsoidal in contour, with their major axes in line with the longitudinal axis of the pterygoid of the same side. Posterior to these two facets, the quadrate extends well posteriorly; and on the outer side of this extension we find the little cup-like depression for articulation with the hemispherical facet on the mesial aspect of the proximal end of the quadrato-jugal part of the zygoma. When articulated, as in life, this posterior extension of the quadrate in *Cereopsis* comes in contact with the antero-inferior angle of the external border of the tympanic ring, and to all appearances there is something after the order of a pseudo-articulation at that point (No. 19,711, Coll. U.S. Nat. Mus.) This does not obtain in any other wild Goose examined by me. The orbital process of the quadrate is well developed, being a strong, pointed apophysis, and directed, when the bone is articulated, upwards, forwards, and inwards. As to the *mastoid head* of the bone, I have not been able to examine it, as its ligaments hold it firmly in place in the skull at hand, which is not mine. However, this head of the bone is probably double—that is, there are, perhaps, two facets for articulation with the squamosal, with a well-marked lineal depression separating them. This is the case in most *Anseres*, and in the quadrates of all the various species of wild Geese examined by me. Of these two facets, the internal one is the larger (*Chen*, *Branta*, *Anser*).

In *Chen hyperboreus*, on the mesial aspect of the quadrate, below the internal mastoidal head, there is a large pneumatic foramen, and I believe that air gains thorough access to the bone under consideration in *Cereopsis*, as well as to the major portion of the rest of its skull, including the lower mandible. Hemispherical in form, the facet for the pterygoid of the same side occupies its usual site—that is, just above the mesial mandibular condyle.

Throughout the *Anserinæ* the general character of the quadrate is the same, and in this it closely agrees with the bone as we find it in many of the *Anatinæ* and *Fuligulinæ*.

Cereopsis possesses a pair of *pterygoid bones*, fashioned pretty much as we find them in the *Anseres* generally. Either one of them presents an enlarged anterior end, with a much smaller hinder extremity, the latter bearing the cup-like facet for articulation with the quadrate. Between these two extremities the shaft of the bone is somewhat slender, and twisted upon itself. Its three borders are inclined to be sharp, and the distal end of the bone is laterally compressed—the interior one passing the entire length of it between the articular ends. On its upper side, distally, there is a large, elongate, sub-elliptical facet for articulation with a similar one on the rostrum of the presphenoid. The major axis of each of these articular facets is placed, for the most part, longitudinally, though, were the imaginary lines produced, they would intersect at a point about where the vomer terminates posteriorly.

At its anterior end, the *pterygoid* articulates with the hinder extremity of the palatine of the corresponding side. This articulation is a pseudo-enarthrosial one—the pterygoid furnishing the "cup" and the palatine the "ball"; while, above the former, the lip of the pterygoid is produced as a process, as is likewise the lip below. Of these two labia the superior one is always the longer, and here in *Cereopsis* closely fits into a snug depression intended for it, on the supero-posterior end of the palatine. This is an unusual arrangement, for this superior-distal process of the pterygoid commonly forms an arthrodial articulation with the palatine, gliding upon that part of its surface with which it is in contact. This upper process of the distal end of the pterygoid is very long in *Tachyeres cinereus*, but short in *Branta* and in some other Geese.

The morphology of a *palatine* bone in the skull of *Cereopsis novæ-hollandiæ* is well shown in fig. 19 of Pl. XXXI. of the present paper. Anteriorly, in the case of either of them, the extremity is broad and flat, and considerably compressed from above downward. This is placed in the horizontal plane, and a wide interval exists between the two bones. Anteriorly, this is filled in by the fused maxillo-palatines: while, externally, the corresponding maxillary is wedged in—the whole being fused together, and, with the premaxillary and nasals, forming one co-ossified structure.

Each palatine, for its distal moiety, sends toward the mesial line a broad, curved surface. This is thin, being convex above and correspondingly concave on its basal aspect. Each meets the vomer in the middle line, and at this place of meeting, beneath the presphenoid, they articulate with each other. More posteriorly they diverge, to meet and articulate with either pterygoid bone. On the under surface of a palatine there is a distinct ridge formed, commencing at the pterygoid articulation, to be carried forwards as the mesial edge of the bone, to the point where it comes in contact with the maxillo-palatine of the same side. The intero-anterior palatine vacuity, divided mesially by the vomer, is oval in outline and very broad in *Cereopsis* (fig. 19). It is continuous above with the spacious rhinal chamber of this Australian Goose.

Tachyeres cinereus has its *palatines* straighter, narrower, and placed nearer together than in *Cereopsis*. It also has that which the latter has not—a large pneumatic foramen on the outer aspect of the bone. In both of these birds the postero-external angle of the palatine is slightly produced—that is, not rounded, as we find it to be in *Chloëphaga hybrida*, and perhaps in other species. In *Tachyeres*, again, the palatines — from where they meet superiorly behind, where they clasp the vomer—each sends forward a process that moulds itself upon and contributes to the superior rounded and projecting border of the vomer. This appears also to be the case in *Cereopsis*, in which species the *vomer* is a weak and imperfectly ossified bone, the antero-superior apex of which fuses with the maxillo-palatines in the median plane.

Tachyeres, among the *Fuligulinæ*, has a big, deep vomer, convex above and straight below, with its supero-anterior *free* end carried forwards as a sharp spine.

Chloëphaga poliocephala also has a large vomer, while it is free anteriorly and poorly ossified in the skull I have at hand of *C. hybrida*. In the American Geese of the genera *Chen*, *Anser*, and *Branta*, it is fairly well developed—especially in *B. canadensis*.

The *mesethmoid* in *Cereopsis* is almost hidden from view by the bones on either side surrounding it; but its abutment above, beneath the cranio-facial region, is not extensive, while it is particularly so in *Chloëphaga* and *Tachyeres*, where, owing to the formation of the surrounding bones in the dried skull, one may appreciate its entire extent, and observe the broad table it affords for the frontals, nasals, and premaxillary processes to rest upon.

In all the Geese named above, the mesial anterior border of the mesethmoid is sharp, it being short from above downwards in *Branta*, where, at its lowest point, a sharp spine protrudes forwards. This last is furnished by the anterior apex of the *presphenoid*, all this part of the cranium having become thoroughly fused together in the adult.

In the skull of *Cereopsis novæ-hollandiæ* at hand the *ossicles of the middle ear* have remained intact, and it is to be noted that the *medio-stapedial element* is performed in bone, it having the usual form, and the shaft rather long. The *supra-stapedial*, *extra-stapedial*, and the *infra-stapedial*, all being in cartilage, present the usual avian characters for this group of birds, and, morphologically, they differ but little throughout the *Anseres* in so far as I have examined them (*Chen*, *Branta*, &c.)

For a bird of its size, the *sclerotal plates* of the sclerotal circlet or ring, in either eye, are both small and few in number in *Cereopsis*. With the form usually observed for them, they number, in either eye, from 12 to 15, and are particularly narrow between their inner and outer peripheries, in that part of the ring which is situated anteriorly, the eyeball being lodged in the orbit as in life. Without making a very minute study of them, the sclerotals of the eyes of other Geese do not seem to be in any way markedly different from those of *Cereopsis*; they each have the usual quadrilateral form, with the angles slightly rounded off. The posterior ones approach the square in outline, and the anterior ones the parallelogram.

The *mandible* in *Cereopsis novæ-hollandiæ* is quite different, in some respects, from that bone as we find it in *Anser*, *Chen*, or *Branta*. It is likewise very unlike the lower jaw of such a species as *Tachyeres cinereus* among the fuliguline Ducks, though we begin to see its characters faintly reproduced in the mandible of *Chloëphaga hybrida*, and very decidedly so in the mandible of *Chloëphaga poliocephala*. As a matter of fact, apart from the question of size (the bone being one-third larger in *Cereopsis*), the bones in these two Geese possess identically the same characters.

Viewed from above, the mandible is seen to have a somewhat broad U-shaped outline, and is comparatively much shorter, everything else being equal, than the mandible in other kinds of Geese. For example, in *Chen hyperboreus* it is seen to be of the long, somewhat narrow V-shaped pattern, with the dentary portion very thick, its upper border longitudinally concave, and correspondingly convex below. In either of these Geese the symphysis is of fair depth, being convex inferiorly and concave superiorly, and marked with the usual groups of nutrient foramina. On the upper side these always appear to be confined mostly to a double row, just within the anterior symphysial margin.

The dentary portion of the mandible in *Cereopsis* is low, not very thick from side to side, and externally lacks the deep and curved groove found on the mandible in this locality in *Chen*, *Anser*, *Branta*, and other Geese. We only find in this place in *Cereopsis*, about half-way between the symphysis and ramus, an elongate nutrient foramen, or the opening may be for a nerve exit. (This is well seen in fig. 1, Plate XXVIII.)

The ramal portion of the mandible in *Cereopsis* is not much loftier than the dentary part, while it is notably thin from side to side. In *Chen* and *Anser* this ramal part is conspicuously high, with a sharp, straight, superior border, the latter being rounded below, and continuous with the inferior rounded dentary border and that of the angular process which projects posteriorly. About the middle of the ramal side, externally, and above the mid-longitudinal line, opposite the point where the high part of the ramus begins to slope to the articular facet of the same side, there is found, on the jaws of all Geese, a more or less prominent process for muscular attachment. It is rather feebly produced in *Cereopsis*, but very strong, prominent, and directed upwards and backwards in such a Goose as *Chen hyperboreus* and its allies.

The mesial aspect of the mandible in *Cereopsis* and most anserine fowls is smooth and flat, presenting no special points for description.

On the upper side of either articular end we note the two facets for articulation with the quadrate; the usual slender *external angular* process directed inwards and upwards, and, finally, the long, very gently upward-curved *posterior articular process*. Mesially, in the recess between these two processes we find a small nutrient foramen in the mandible, on either side, in *Cereopsis*, which opening is of great size in some of the large fuliguline Ducks, as, for example, in *Tachyeres cinereus*; rather less in some Geese, as in *Branta*, and still smaller in others.

Tachyeres, in contradistinction to the *Anserinæ*, has also the posterior articular process on either side, very long, of a parallelogramic outline, with the supero-posterior angle abruptly produced upwards as a triangular process. (Fig. 23, Plate XXXII.) All the true Geese before me at this writing have the long, slender, gently curved, sabre-shaped posterior articular processes—so different from what we find in the form of that apophysis in *Tachyeres*.

A number of years ago I made a drawing for Dr. Elliott Coues of the *hyoid bones* of *Branta canadensis*, seen on dorsal view, which he published in the fifth edition of his "Key to North American Birds" (fig. 72, p. 173). This same drawing I reproduced in my "Osteology of Birds," published in 1909 by the State Museum of Albany. (Fig. 42, p. 314.) As I have no drawings of the *hyoidean apparatus* as found in Geese to present with this paper, I mention these facts, in that a reliable figure of the tongue-bones of a Goose will be at hand for comparison by those who may have either of the above works available, with the description which here follows

As in the case of all Geese, *Cereopsis novæ-hollandiæ* has the skeletal parts of the lingual apparatus perfectly developed, and in no way especially differing from those structures as we find them in a number of its congeners.

The *glosso-hyal*, with its anterior tip finished off with cartilage, is barely half the length of that bone of the arc as we find it in *Branta canadensis*, and of a different form. This last-named bird has a glosso-hyal measuring 3 centimetres in length, with an average width of 6 millimetres, all the angles being rounded off. It is concave dorsally, and correspondingly convex below. The cartilage that finishes off its distal end is of about three-fourths the width of the bones itself, while at the proximal extremity the facet for the basibranchial is very large, as compared with that part of this articulation in other Geese.

In *Cereopsis* the glosso-hyal is *triangular* in form, with the apex at the anterior tip, where it is completed with a mere nib of cartilage. Its mid-longitudinal line measures but 15.5 mm., and its greatest width posteriorly, where the lateral angles are somewhat produced, 7.5 mm.

As in *Branta*, the *first* and *second basibranchials* are fused into one piece—the first being of a trapezoidal form and the latter a mere spike extending it posteriorly. Anteriorly, it presents an upper and lower lip, forming an articulation for the glosso-hyal in front of it. From either side of this bone of the hyoid arches, at a point where the basibranchials have co-ossified together, there springs a *thyro-hyal*, the facet of articulation looking backwards and outwards. As usual, a *thyro-hyal* is composed of two pieces, the anterior one being the *cerato-branchial*, which is here a nearly straight and slender rodlet of bone, measuring some 37 mm. in length, which is equal to the length of that bone in *Branta canadensis*, only in the latter Goose it is somewhat stouter, more curved, and has a larger head anteriorly. The posterior piece, called the *epi-branchial*, is not more than half as long as the cerato-branchial, and is uniformly curved throughout its length so as to accommodate itself, in life, to the form of the back of the cranium. Either of these *epi-branchials* is concaved for its entire continuity dorsally, and correspondingly convex ventrally, the distal end being tipped with a bit of cartilage. This is also the case with the *uro-hyal* or second basibranchial.

Branta canadensis has an *epi-branchial* likewise curved upward, but the bone is semi-cylindrical in form, and thus differs entirely from what we find in *Cereopsis*.

In *Chen h. nivalis* the glosso-hyal is greatly elongated and very narrow. Judging from the dried and roughed-out specimen at hand (No. 18,611, Coll. U.S. Nat. Mus.), it would appear that, in this species, the large tip of cartilage terminating its distal extremity may ossify, and thus form an *accessory glosso-hyal*. The rest of the apparatus practically agrees with what we find in *Branta*.

Throughout the *Anseres* the bones of the hyoidean apparatus differ, to some extent, for different species and genera; but they are upon the same plan, and generally well developed. I have examined them for a large number of birds of this assemblage, including *Dendrocygna*, *Hymenolæmus*, *Oidemia*, *Olor*, and many of the *Anatinæ* and *Fuligulinæ*.

So far as I have compared the *hyoidean apparatus* of *Cereopsis novæ-hollandiæ*, I find nothing in its morphology that points to the near kinship of any of the Geese or Ducks I have mentioned. As to *Chloëphaga*, *Tachyeres*, *Coscoroba*, and other important forms, I have no material at hand representing the bones of the *hyoid arches* in them.

There is considerable literature extant upon the ossifications of the *respiratory* and *vocal organs* of the *Anserinæ*; but, inasmuch as these were not preserved in the only skeleton I have at hand of *Cereopsis*, I shall be obliged to omit a description of those parts which ossify in the *larynx*, *trachea*, and *bronchial portions* of the air-passages of this Goose.

ON THE REMAINDER OF THE AXIAL SKELETON IN CEREOPSIS NOVÆ-HOLLANDIÆ.

The Vertebral Column.—Most Geese agree very closely in the number of vertebræ any species may possess in its spinal column. *Branta canadensis*, *Chen hyperboreus*, and the Goose now under consideration all have 18 vertebræ in the cervical division of the spine that are without free ribs. These are followed by the nineteenth and twentieth, each of which has a pair of free ribs, but they do not reach the sternum. From the twenty-first to the twenty-fourth, inclusive, they are true dorsals; while in *Cereopsis* and *Branta*, from the twenty-fifth to the forty-third, inclusive, are sacral vertebræ co-ossified with the pelvis. In the case of *Chen* the sacrum only includes the forty-first. Not including the *pygostyle*, the vertebræ in the tail of *Cereopsis* are from the forty-fourth to the forty-eighth inclusive; in *Branta*, from the forty-fourth to the forty-ninth inclusive; and in *Chen*, from the forty-second to the forty-seventh inclusive. In all this *Anser albifrons* agrees, with the exception that, in that Goose, only the nineteenth vertebra possesses a pair of free ribs which do not connect, through hæmapophyses, with the sternum.

Atlas vertebra has an antero-posteriorly broad neural arch, which is smooth dorsally and unsurmounted by any neural spine, while a rudimentary hæmal process is found, mesially, on the arch below the atlantal cup for the occipital condyle. Laterally, the *vertebral canals* are closed in to the outer side, in either case, by a mere slender span of bone of hair-like calibre. These last are somewhat stouter in the *axis vertebra*, which has a large quadrate hæmal spine, and a low, thick neural one, situated far back on the still thicker neural arch.

After passing the axis, a neural spine is found upon the third cervical to the ninth, inclusive, it being, up to include the eighth, a long, low lamina of bone, with a smooth convex superior margin.

On the ninth vertebra it occupies a middle place on the centrum, and is much shorter antero-posteriorly, but has the same convex superior border. In the *tenth cervical* there is a low, rudimentary neural spine, which, in the eleventh, twelfth, and thirteenth, has almost disappeared. In the fourteenth, fifteenth, and sixteenth it is antero-posteriorly notched, giving the process a bifid appearance. In the seventeenth, and still more in the eighteenth, it assumes the quadrate form of the neural spine in the dorsal series of vertebræ.

Pre- and post-zygapophyses in the third and fourth cervicals are joined by hair-like spans of bone; but in the fifth they have disappeared all to their endings.

There is a long, low hæmal spine on the third cervical, which is rudimentary in the fourth, and makes way for the ending of the carotid canal in the fifth. This latter extends to include the fifteenth cervical, being broad and open in the anterior part of its course, to become narrower and more enclosed as we pass backward. At the sides of the cervicals the pleurapophyses are long, and terminate with a well-marked process on either side, posteriorly; they assist in most effectually closing in the long *vertebral canals*. In the seventeenth vertebra they assume the form of a rudimentary *rib*; but it is not free, being still fused with the transverse process and centrum of the vertebra on either side. However, in the eighteenth vertebra their places are taken by a pair of long, free ribs that support "epipleural appendages."

It may be remarked here that, with the exception of the atlas, the entire skeleton of the trunk in *Cereopsis novæ-hollandiæ* is more or less pneumatic, air being very freely admitted to most all the bone through foramina occupying their usual sites when present.

Throughout the cervico-dorsal region of the spine the neural canal is of a cylindrical form, quite uniform in calibre, being of but moderate capacity.

As in other existing *Anseres*, the cervical vertebræ of *Cereopsis* are all heterocœlous.

In the *dorsal region* of the spinal column of this Goose we find *four* vertebræ, and these, in life, are very intimately articulated with each other. Their *neural spines* are thick, somewhat lofty, and their superior borders are likewise much thickened, being anteriorly and posteriorly extended in order to lock with each other, which is accomplished by the anterior end of each being bluntly pointed to fit into a corresponding notch on the hinder end of the superior border of the neural spine in front of it.

These neural spines are moderately lashed together by the ossification of the tendons of certain muscles of the back. Similar ossifications on the dorsal aspects of the outer ends of the transverse processes of these vertebræ, in conjunction with the metapophyses, tend to still further bind the dorsal vertebræ together. The centra of these vertebræ do not exhibit much lateral compression, and they are pierced here and there by pneumatic foramina of various sizes.

For each pair of ribs the facets are slightly raised, and are to be found far forward on the centrum of each vertebra. The *neural canal* is of considerable calibre, and in the articulated skeleton may be seen into through the circular vacuities formed between each contiguous pair of vertebræ by the articulating of their pre- and post-zygapophyses.

There is a low, lamina-like spine on the first dorsal vertebra, and a more conspicuous one on the second, which is bifid below; but after that these zygapophyses are absent. (Fig. 25, Plate XXXIII.)

Rather broad antero-posteriorly, the *dorso-vertebral ribs*, in the skeleton of *Cereopsis* at hand, are transversely much compressed. Their free borders are sharp, and about at the middle of the posterior one of each there is found an anchylosed *epipleural* *appendage*, the distal extremity of any one of which is truncate almost transversely to its long axis. Any one of these dorsal ribs possesses a somewhat enlarged head, a laterally compressed tubercle, and a slightly constricted neck. On the posterior aspect of the latter, between the capitulum and tuberculum, there is, in the first three pairs of these dorso-vertebral ribs, an unusually large and open pneumatic foramen. There are also smaller openings of this kind on the anterior aspect of the necks and elsewhere.

The *hæmapophyses* or *costal ribs* are also highly pneumatic, and these bones are likewise laterally compressed, with increasing lengths as we follow them backward.

While considering the ribs, it will be as well to note that there are two pairs of perfect *sacral ribs*, agreeing in all respects with those of the dorsal series, barring their gradually increased lengths and the lengths of their long costal ribs, each pair of which reach the costal borders of the sternum in a perfect articulation. The latter pair of these two pairs of "dorso-lumbar" ribs do not support uncinate processes, as do the first pair.

The next following pair of ribs are rudimentary and largely fused, in the matter of their articulation, with the ilia and their vertebræ. Here, both the pleurapophyses and hæmapophyses are long and slender; the latter, on the right side in this skeleton, reaches the sternum to articulate with the ultimate facet on its costal border; while, upon the left side, the hæmapophysis does not reach the costal border of the sternum by 2 or 3 millimetres—that is, it is a "floating costal rib."

There is, posterior to these latter ribs, another rudimentary pair of "sacral ribs" with "floating hæmapophyses," and, posterior to these again, there may be a final rudimentary pair, with or without floating ribs. As to the exact osteology of these latter, I cannot be quite sure, as they are broken off in the skeleton at hand, and a part of another skeleton before me does not include the ribs.

Fig. 25 of Pl. XXXIII. of the present paper exhibits very well the broken and imperfect ultimate ribs in this skeleton (No. 18,571, Coll. U.S. Nat. Mus.), while the "skeleton" of *Cereopsis novæ-hollandiæ* (No. 19,734, Coll. U.S. Nat. Mus., marked "Body") consists of the cervical and dorsal vertebræ complete; the four free caudal vertebræ and pygostyle; the femora; the imperfect hyoid arches; a perfect larynx and the first three or four rings and semi-rings of the trachea.

Branta canadensis and *Anser albifrons* have four pairs of ribs belonging to the dorso-lumbar vertebræ, articulating with them as in *Cereopsis*, beneath the eaves of the ilium upon either side, while *Chen hyperboreus nivalis* possesses but three pairs of them, the last pair being very rudimentary and slender.

The Pelvis and Coccygeal Vertebræ.—Agreeing with a number of other species of existing *Anserinæ*, *Cereopsis* possesses an elongate and comparatively narrow pelvis—indeed, actually as well relatively speaking, the preacetabular portion of it is longer and somewhat narrower than the same portion in representatives of the genera *Chen, Branta,* and *Anser* (fig. 15, Plate XXX., fig. 25, Plate XXXI.), while it more nearly resembles that part of the pelvis in *Olor*, either *buccinator* or *columbianus*. In these Swans, however, the last lumbar vertebra fuses with the first dorso-lumbar, and consequently protrudes beyond the ilia, which it does not do in the case of the Geese.

Such species as *Hymenolæmus malacorhynchus* and *Chenonetta jubata* possess the Duck-like form of pelvis, so comparisons would avail us nothing in this respect with them. (Fig. 5, Plate XXIX., and fig. 26, Plate XXXIV.)

In *Cereopsis*, from the somewhat stunted prepubis to the rounded antero-lateral angle of the ilium, on either side, the rather roughish border is concave inward, while the side of the bone above it is quite uniformly concaved, and faces for the most part outward, having nearly the same depth throughout. For rather more than its middle third, the inner, which at the same time is the superior, border fuses completely with the superior border of the neural spines of the dorso-lumbar vertebræ. Posteriorly, on either side, this border curves outward to bound the post-acetabular area anteriorly. (Fig. 15, Plate XXX.)

Further, we are to note upon this dorsal aspect of the pelvis of this cereopsine Goose that, mesially, in the post-acetabular area, the *sacral vertebræ*, as well as a number of the leading *uro-sacrals*, are most completely fused together and with the ilium on either side. So complete is this co-ossification that but a very few minute vacuities remain between the transverse processes of the vertebræ, and these afford but the barest hint as to the limits of the bones involved in the amalgamation. In the case of the last three uro-sacrals, their transverse processes become more and more distinct or individualized as we proceed backward. The transverse processes of the leading one of these three articulate, in the usual manner, with the ilia; the next following one is much smaller, and its transverse processes do not reach the iliac borders; while the last one, which closely resembles a true caudal vertebra, is grasped by the ilium upon either side—a conspicuous process being thrown out to meet the ends of the transverse processes of the vertebra. This is well shown in fig. 15 of Plate XXX. There is no approach to anything like this in any pelvis of Goose or Swan thus far examined by me.

On lateral view there is to be observed the large, circular *acetabulum*, the inner ring being about one-fourth smaller than the outer. These rings are nearly of equal size in *Branta canadensis*, but showing only slight differences in their diameters in *Olor* and *Chen*. The form of the *antitrochanter* varies but little among the various genera, and the small, elliptical *obturator foramen* below it is better divided from the large, elongate *obturator space* in *Cereopsis* than it is in other Geese, or in the Swans.

From the lower arc of the obturator foramen backward almost to the point where the postero-inferior angle of the ischium abruptly sends down a broad process to meet it, the *pubic element* is long and slender. At the point defined it is as much as three or four times as broad, but contracts very gradually as it proceeds backward towards its free end, where it moderately expands again to form the dilation there existing. This expansion at the distal free end of either pubic bone in *Branta* and *Olor* is conspicuously large and paddle-shaped, while in *Chen* it is almost as we find it in *Cereopsis*, the only difference being that, in the former, the bone, after passing its articulation with the ischium, is more abruptly curved downward.

In all these genera there is a marked *ischio-iliac notch* on the posterior pelvic border, which in *Branta canadensis* is converted into a foramen by the ilium and ischium meeting behind it again. (No. 17,980, Coll. U.S. Nat. Mus.) Sometimes, in *Chen hyperboreus*, there is a minute foramen anterior to the notch on either side that I have noticed in other pelves.

In *Chen cœrulescens* the ischio-iliac notch is particularly deep in some specimens.

On the dorsal aspect of the pelvis, mesially, between the acetabula, backward to a point about opposite the posterior endings of the ischio-iliac foramina in *Olor* and *Branta*, the entire area is much concaved, being deepest in the median line, and rolling up on either hand above the antitrochanter anteriorly, and the elongate, large ischio-iliac foramen, posteriorly. This region is somewhat concaved in *Cereopsis*, but very much less so in *Chen*, in which latter genus the ilia are conspicuously separated from the uro-sacral vertebræ, which is not the case in *Branta*, and only in the case of the last two vertebræ in *Olor columbianus*.

Viewed ventrally, the pelvis in *Cereopsis* is very narrow and contracted anteriorly, but broader, deep, and capacious after passing the acetabula. This is more or less the case with all these Swans and Geese, though in *Olor columbianus*—a very big bird—the shortest distance between the ischio-iliac foramina measures but 32 mm., while in *Cereopsis*—a much smaller fowl—it measures 40 mm.

In this Cape Barren Goose of Australia the skeleton of the tail is not as well developed as it is in other anserine genera. The four *caudal vertebræ* composing it have short, stumpy neural processes with clubbed extremities, while the transverse processes are short and depressed. Rudimentary, free *chevron bones* are to be found between the last two or three of these vertebræ, being represented merely by twin ossicles resting on the transverse line of the articulation between the centra of contiguous vertebræ. Subquadrilateral in outline, the *pygostyle* is small for the size of the bird, and in keeping with the vertebræ in advance of it. Its upper border is sharp, while the lower one is thickened, longitudinally grooved, and harbours three or four large pneumatic foramina.

This is also the case in *Olor columbianus*, in which bird the distal end of the pygostyle is somewhat produced—an elongation which, in *Branta canadensis*, is very marked. In this Goose, too, there are six free caudal vertebræ, which in the case of the third, fourth, and fifth have long, deflected transverse processes, and thick (but by no means lofty) neural spines. The fifth vertebra of this series in the skeleton at hand has its transverse process on the right side profoundly bifid, the bifurcations being slender and spreading. Chevron bones occur as in *Cereopsis*. In *Chen* the caudal vertebræ are non-pneumatic, and for size they hold an intermediate place, being somewhat better developed than they are in the Australian species, and not as well as they are in *Branta canadensis*.

The Sternum.—Dorsally, the sternum of *Cereopsis* is profoundly and doubly concave, the two concavities merging into each other in such a gradual manner as to be hardly perceptible. The transverse line approximately dividing them may be considered to pass just a little posterior to the facets on the costal borders for the ultimate pair of hæmapophyses.

Similar double concavities characterize the dorsal aspects of the sternum in *Branta* and in *Chen*, and doubtless in other Geese, the anterior one being for the thoracic organs and the posterior for a part of the abdominal ones.

On the *costal borders* the articulations for the *costal ribs* present their usual avian characters as seen in ordinary birds. They are directed backwards, upwards, and outwards—very much outwards in the case of *Chen hyperboreus*, and even more so in *Branta canadensis*.

Posteriorly, the xiphoidal part of the bone presents two profound "notches," being elliptical in outline.

The lateral xiphoidal processes thus formed are long and nearly of equal width throughout, averaging about 7 mm., while the median xiphoidal process is wide, its hinder border being sharp and transverse. It has an average width of about 3 centimetres.

In *Branta canadensis* the notches are more broadly elliptical in outline; the lateral xiphoidal processes relatively longer, with their ends, posteriorly, somewhat expanded; while the postero-external angles of the mid-xiphoidal process are laterally considerably produced. This is also the case in *Chen hyperboreus nivalis*, but not so much so.

Anteriorly, the border of the sternum in *Cereopsis* is much thickened, convexed forwards, with its face in front being modelled to form the articulations for the coracoids; and when these latter are articulated as in life, they do not meet mesially, the contracted interval being a small, rather shallow pit. This is also the case in *Branta*; while in *Chen* the coracoids come in contact in the median line.

In all these Geese the *costal processes* are quadrilateral in outline, rather large but not lofty, while below either one of them, at the outer ending of the coracoidal groove, there is another sharp process developed—an osseous, broadly triangular lip, which serves to keep the coracoid of either side safe in its articulation.

There is no *manubrium* on the sternum of the Cape Barren Goose, while quite a prominent one is found in *Branta*, which is short and peg-like in *Chen.*

Immediately over the anterior border, in the median line posteriorly, there is always present a circumscribed, rather deep and sizable concavity, the base of which is perforated with a numerous group of small foraminal openings for the admission of air into a large part of the anterior portion of the sternum.

On either side of this median pit, occurring as it does on both *Chen* and *Branta*, there are collections of small pneumatic foramina, extending around as far as the base of either costal process. These do not exist in the sternum of *Cereopsis*, where all this part of the sternum is smooth and unbroken, not having the thickened posterior rim so prominent in *Branta canadensis*, and nearly as much so in *Chen hyperboreus* and *C. cærulescens.*

In *Olor columbianus* and other Swans this is quite different, there being no median pneumatic concavity just over the anterior border; while in place of it there is an elevation of some size, its middle part being thickened, and extends up to merge with the anterior border in the median line. As a matter of fact, the sternum of a Swan is so unlike that bone in *Cereopsis* in so many particulars that a comparison would avail us nothing beyond a demonstration of the decided osteological differences existing between an average Goose and one of the *Cygninæ* in this part of their skeletons.

The sternal carina in *Cereopsis* is ample and deep anteriorly, while it slopes away gradually as we proceed backward, to be finally lost on the mid-xiphoidal process at a distance of some 2 centimetres from its hinder border. Anteriorly, the border of this keel is thickened and concaved, more so than in either *Chen* or *Branta.* Likewise, the lower border of this keel is thick and smooth, being evenly convex outward from the carinal angle in front to where it is lost on the surface of the bone posteriorly. (Fig. 25, Plate XXXIII.)

The ventral surface of the sternal body is smooth and convex, presenting for examination but the single muscular line on either side of the carina, extending from the middle point of the coracoidal groove, backward, to be lost on the surface of the bone between the "notch" and the termination of the keel. This muscular line is very strong and elevated in *Branta*, and more or less in all the *Anserinæ.* It is the boundary-line between the three pectoral muscles of the breast ("Myology of the Raven," p. 71, fig. 25).

A similar "muscular line" traverses either side of the keel, running from a point on the anterior border, at the junction of its middle and lower thirds, to be lost on the surface of the bone, near the end of the carina, in *Cereopsis*; but in *Branta canadensis* distinctly joining the termination of the line (in a rounded curve) described above as passing down the ventral aspect of the bone. This line is also a boundary one between pectoral muscles, and is present on the keel of the sternum in most ordinary birds.

The Pectoral Arch or Shoulder-Girdle.—All the bones composing this arch in the skeleton of the Goose now being considered are, in the highest degree, pneumatic. In the *scapulæ* the foramen is found on its dorsal aspect, in the middle line, close to its coracoidal articulation. In the *coracoids*, a group of these foramina is found on the mesial aspect of the superior end of the bone, under the eaves of the overarching head; and in the *os furcula*, on the outer side of the free clavicular extremity at its broadest part. It will be noted from this that when the bones of the girdle are articulated, as in life, their pneumatic foramina are all in the neighbourhood of each other and directed toward the *foramen triosseum.*

When duly articulated, the *scapulæ* reach almost as far back as the pelvis, either one of these bones being thick and flatly rounded anteriorly; bluntly pointed at the distal apex; arched throughout in that it may conform to the skeletal wall of the thorax; while the head, anteriorly, articulates with both coracoid and furcula in a manner common to the *Anseres* generally. With the coracoid of the same side it helps form a commodious glenoid cavity, the boundaries of which, front and back, are thickened and raised.

The *coracoids* are big bones in every particular, as they are in all species of wild Geese. Their sternal extremities are very much expanded and flattened antero-posteriorly. As usual, the lower outer angle extends backward as a fairly prominent process, though more so than it is in *Olor* or *Branta.* As all the superior parts of the bone are of large proportions, the shaft between these and the expanded lower end is so much shortened thereby that it has the appearance of being but little more than an intervening "neck," which is a condition that by no means exists in all *Anseres* where the coracoidal shaft is much longer.

The *os furculum* is of the broad, U-shaped pattern, and is entirely without a hypocleidium. In structure it is rather stout, with either, somewhat enlarged, clavicular extremity drawn out into a long, rather sharp, end, which in life, or in the duly articulated skeleton, glides over the antero-mesial surface of the scapula on either side.

At the arch below, the posterior surface is roundly convex; but this becomes flat as we proceed toward the clavicular ends. In front the arch is also flat, with a very slight inclination to become concave from side to side.

In the articulated skeleton this latter surface faces mostly upwards, and is lost on the smooth, flat limb of either clavicle higher up, on their mesial aspects.

There are no *acromial processes* present on this *os furculum* as there are in *Branta canadensis*, to a very slight extent in *Chen*, and are conspicuous characters in so many Ducks and Mergansers.

In *Branta*, the fourchette is non-pneumatic, while in *Olor* it is much modified in its morphology at the lower part of the arch, in order to accommodate the passage of the trachea to and from the tracheal chamber of the sternum in members of that genus.

THE APPENDICULAR SKELETON.

The Pectoral Limb (fig. 22, Plate XXXI.)—In this Goose the skeleton of the wing presents every indication of powerful development, suggesting at once a bird endowed with the maximum capacity of flight.

The *humerus* presents the usual sigmoid curves from proximal to distal end, though in no marked degree. It has an extreme length of about 171 millimetres, and is completely pneumatic, the air gaining access to the interior of the bone through a large elliptical foramen situated, as usual, in the pneumatic fossa on the anconal side of the bone, beneath the eaves of the ulnar tuberosity. The lower boundary of this is extended as a thin, sharp crest or border, which is lost upon the shaft not far from the pneumatic opening (*crista inferior*). *Caput humeri* is large and smooth, being separated from the ulnar tuberosity by a well-marked *incisura capitis*, which gives especial prominence to the *tuberculum internum.*

There is a very conspicuous *radial crest*, which has a somewhat thickened, convex border. It is bent over so far palmad as to be almost perpendicular to the palmar aspect of the shaft, it being extended down the latter to a point about at the junction of the proximal and middle thirds. At its widest part the proximal extremity of the humerus measures about 33 millimetres. The middle third of its shaft is subcylindrical in form, and very smooth.

At the distal extremity we are to note the usual radial and ulnar tubercles for articulation with the bones of the forearm, and proximad to them a fairly well marked depression indicating the site for the insertion of the *brachialis anticus* muscle. Prof. Fürbringer designates this depression as the *fovea supra-trochlearis ventralis des Humerus* in the common Goose, and states that the *brachialis inferior muscle* arises there, which statement is also made by Dr. Gadow in Newton's "Dictionary of Birds" (p. 439).

The ectepicondylar process is but feebly pronounced at this distal end of the humerus in *Cereopsis*, and the same may be said for the entepicondylar one on the other side of the bone.

In *Chen hyperboreus* the humerus is somewhat smaller than the bone in this Cape Barren Goose, but the characters are identical.

Passing to the *ulna*, we find it to have a length of some 173 mm., the radius being but a trifle shorter. Down the palmar aspect of the ulnar shaft there is a fairly distinct raised line, slightly broken at nearly regular intervals by minute elevations, averaging some 11 mm. apart. This line is quite straight, and indicates where the quill-butts of the secondary feathers are inserted in life. Proximally, the head of the ulna is very large, and the big shaft immediately beyond it is trihedral on section. For the rest, it is nearly cylindrical, while its distal end presents the usual characters of the bone as seen in the *Anseres* generally.

The shaft of the *radius* is but slightly double-bowed, and has a calibre of about one-third of that of the ulna.

At the *carpus* we find the two usual carpals—the *radiale* and the *ulnare*—each presenting the ordinary ornithic characters.

Carpo-metacarpus has an extreme length of some 97 mm. Its main shaft (index metacarpal) is straight, subcylindrical, and short, while that of the third metacarpal is but slightly bowed. The *proximal phalanx* of index metacarpal is elongate and rather narrow, with its posterior expanded portion smooth on both aspects, and never exhibits any vacuities. Other *phalanges* present nothing worthy of special note beyond the fact that there is a claw on both the *pollex digit* as well as upon the distal phalanx of index. The former is not shown in fig. 22 of Pl. XXXI., as it had been lost from the skeleton. It is, however, present on this digit in the right limb.

Chen hyperboreus has the tubercles for the quill-butts of the secondary feathers on the shaft of ulna much more prominent than in *Cereopsis*, and they are found in a row above a line corresponding to the one described above as found on the ulna of the Australian Goose. Otherwise, apart from the matter of size, the bones are quite in agreement with respect to characters, and the same is practically true with respect to the bones of manus on these two anserine fowls.

The Pelvic Limb (fig. 24, Pl. XXXII.)—Differing in some few minor details from the *femur* of either *Branta* or *Chen*, this bone in *Cereopsis* agrees with both of them in being notably stout and strong. In the Goose here being considered, its extremities are bulky and big, and the shortest cylindrical shaft is straight. The femoral head is about sessile with the upper part of the shaft, there really being no neck connecting the two. Its pit for the insertion of the ligamentum teres is very shallow and diffuse. Both caput femoris and the summit of the shaft are in the same plane, while the massive trochanter major, with its superior and circular limiting line, barely rises above the same.

On its external aspect the trochanter major has great transverse width, while the trochanter minor can hardly be defined.

At the distal extremity anteriorly the intercondylar space is very wide, and the surface markedly concaved. The superior ending of the internal condyle does not merge gradually upon the shaft, as does the external one, but presents a characteristic shoulder before doing so. This character is barely noticeable in *Branta* or in *Chen*.

Posteriorly, the *popliteal fossa* is deep, and situated entirely above the internal condyle, which latter is very broad and rounded.

All the usual tubercles and depressions for muscular and ligamentous attachments seen in femora of birds generally are here present at their usual sites, and the *linea aspera* is well marked down the shaft.

None of the bones of this limb is pneumatic, and this is the case with all Geese which I have examined with the view of ascertaining this point.

As a rule, in the *Anseres* the *patella* does not ossify, though occasionally in some species the cartilage of which it is formed becomes very firm and dense—so much so that in dried skeletons the track or groove of the ambiens muscle is plainly to be seen crossing it obliquely. There does not seem to be an osseous patella in the Goose here being described, nor in any of its congeners.

Measuring from the highest point on the entocnemial process of the *tibio-tarsus* to the lowest one on its internal condyle, this bone has an extreme length of 163 millimetres.

The shaft is straight, and for the most part more or less cylindrical. To meet the requirements for articulation with the femur the area of its summit is more than usually extensive—that is to say, in order to provide the requisite room for the concavities to accommodate the femoral condyles. Above this summit rears the cnemial process, divided, as it is in nearly all existing birds, into the ento- and ectocnemial crests. The first of these is the longer, and placed the higher on the shaft. It projects directly to the front, while the somewhat smaller, broadly-hooked one turns directly outward so that it is in a plane at right angles to the first, and when the articular skeleton of the limb is viewed directly from in front completely hides the head of the fibula.

On the outer side of the shaft of the tibio-tarsus, rather more than a centimetre below its summit, there is the *fibular ridge*—an individualized, low crest, 3 centimetres long, the entire length of the free outer border of which articulates with the fibula.

At the distal extremity the condyles are large and uniform in outline. Anteriorly, they protrude considerably, and are rather broad and rounded; while, posteriorly, they are reduced to sharp, low ridges, with a much shallower intercondylar space as compared with the deep and broad one in front. Above the latter there is the usual tendinal canal, which fades away on the anterior aspect of the shaft at about the junction of lower and middle thirds. Just above the condyles on this view we find the usual osseous span across this tendinal groove, and on either hand the usual tuberosities for the insertion of the tendons of certain muscles of the thigh.

This tibio-tarsus of *Cereopsis* is identical in character with that bone as we find it in *Branta canadensis* (No. 17,980, Coll. U.S. Nat. Mus.), even to the matter of length, it being in the Canada Goose only 2 or 3 millimetres shorter.

Practically, this also applies to the *fibula*, though in *Branta* the tubercles and grooves on the outer aspect of its head are more pronounced. In both birds, however, the fibula is much compressed from side to side, tapers gradually, though rather smartly, to the end of the "fibular ridge" upon which it articulates with the tibio-tarsus, after which it becomes very small and slender, and co-ossifies with the side of its companion-bone of the leg, at the commencement of its lower third.

The characters, as above described, of these two bones of the pelvic limb are repeated with but slight differences in the corresponding ones of *Chen hyperboreus nivalis*, and probably other anserines.

With an extreme length of 104 millimetres, the *tarso-metatarsus* of this Cape Barren Goose is proportionately as strong and as straight as the other long bones of this limb.

At its summit, the depressions to receive the articulation of the condyles of the tibio-tarsus are deep and well separated, and especially by the prominent intercondylar tubercle, which, as a rounded elevation, surmounts, at the middle line, the anterior border just above the deep concavity at the head of the shaft of the bone on that aspect.

At the base of this concavity are to be noted the two small foramina, placed side by side, which pass antero-posteriorly through the bone—one to emerge on the internal face of the hypotarsus, and the other passing through it. Below these, anteriorly, we are to observe the small parallel elongate tubercles for the insertion of the tendon of the *tibialis anticus muscle* ("Myology of the Raven," p. 201, fig. 55).

As to the shaft, it is for the most part flat and smooth in front —that is, below the longitudinal groove traversing its upper half, which latter shades away at its middle third. Distally, it is expanded on account of the trochleæ.

Posteriorly, we have above, at its distal end, the *hypotarsus*, which is here very broad, rather deep anteriorly, more particularly so on the mesial side where its hinder border is extended clear down the entire length of the posterior aspect of the shaft, almost to the inner trochlea. There are two other such "guides" to the tendons, which, as fine raised lines, run down the back of the shaft of this bone.

Smooth and flat on its inner aspect, we are to note further, in regard to the hypotarsus, that it has three longitudinal canals for the passage of tendons on their way to the toes. External to these canals, there is still another open groove, also for the accommodation of a tendon. Probably the aforesaid canals do not seal over with osseous tissue until the individual has fully matured with respect to such changes. Prior to that time, these canals are, posteriorly, backed only with fibrous tissue, which is what ossifies later on in life.

Branta has a tarso-metatarsus similar to that bone in *Cereopsis*, but the tendinal groove to the outer side of the hypotarsus is not quite as well defined.

As to the posterior exits of the two foramina that perforate the upper extremity of the shaft, one is found in plain sight at the middle of the base of the hypotarsus on its mesial side; the other occurs at the distal ending of the first canal on the outer side. This is also the case in other Geese, as *Branta* and *Chen*, while in the representatives of the latter genus there are but two grooves, and two closed canals traversing the hypotarsus.

Mid-trochlea is very large, and situated much lower on the shaft than is the one on either side of it. Each is markedly individualized, and the foramen for the anterior tibial artery is of considerable size, occupying its usual site. It communicates with another perforation—a much smaller one—which passes longitudinally through the isthmus below it, connecting the middle and outer trochleæ. This secondary foramen is also present in this locality in *Chen* and *Branta*, and perhaps in other *Anserinæ*.

First metatarsal is free and rather small in this Australian Goose, and the toe it supports with its claw or ungual joint is somewhat feebly developed. On the other hand, the three *anterior toes of pes*, with their 3, 4, and 5 joints, taken in their order from the inner to the outer one, are stout and short, as we would expect to be the case in a bird that spends so much of its time upon the ground.

The ungual joints are big, sharp-pointed, and considerably curved. At their proximal extremities the three basal joints are somewhat massive, while each one, palmad, has its basal moiety deeply grooved in the longitudinal direction for the accommodation of certain plantar tendons.

The proportional lengths of these pedal joints are well shown in fig. 24 of Plate XXXII. of the present contribution.

There appear to be no *sesamoid bones* at the interarticulations of the joints of the toes in the sole of the foot of this Goose, such as we find in some birds which by habit are largely terrestrial, or spend considerable of their time upon the ground.

ON THE AFFINITIES OF CEREOPSIS NOVÆ-HOLLANDIÆ.

Apart from the skull, the remainder of the osteology of this Goose presents nothing to indicate that it is an *anserine outlier* among the *Anseres*. As a matter of fact, many of the characters of its trunk skeleton—and more especially is this the case with respect to the appendicular skeleton—are practically in agreement with the corresponding one in the skeletons of such typical Geese as we have in *Anser*, *Branta*, and *Chen*.

As to the skull, in some particulars, as have been set forth above, it exhibits a number of very marked differences as compared with that part of the skeleton in such genera of Geese as have just been mentioned in the last paragraph. Nevertheless, this skull is withal anserine in its characters, though indicative of belonging to a somewhat aberrant type.

Further, its osteological characters point to the fact that it belongs to a sub-family—the *Cereopsinæ*—distinct from the sub-family *Anserinæ*, and is more nearly related to *Chen hyper-*

PLATE XXVIII.

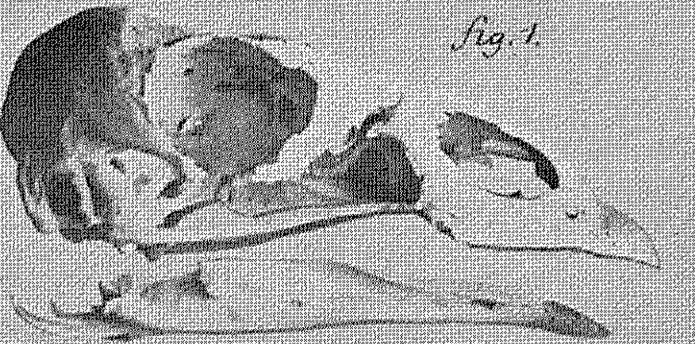
fig. 1.

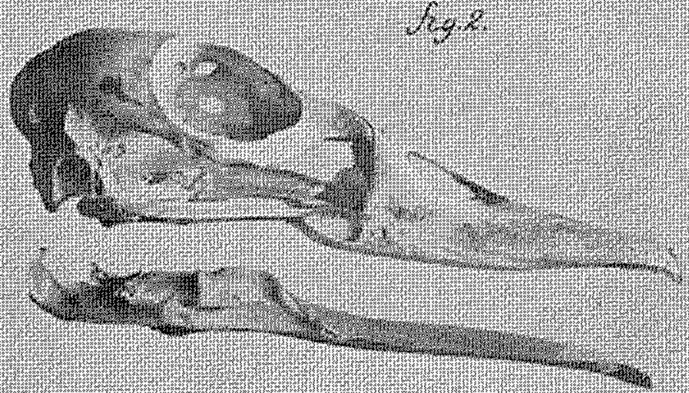
fig. 2.

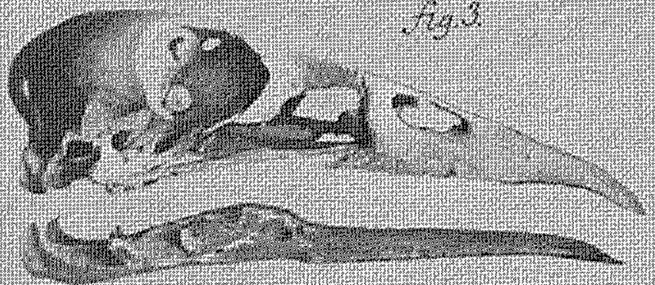
fig. 3.

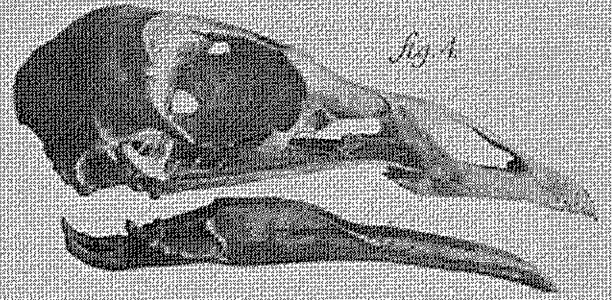
fig. 4.

boreus of the latter than it is to any other species of existing Goose. Possibly, among extinct forms it may have had congeners —and probably did—to which it was more nearly affined than it is to the species just mentioned, but of this I have no knowledge at present.

The opportunity to compare it, osteologically, with the remains of the extinct *Cnemiornis* and *Centrornis*—and especially the first-named genus, of which the fossil remains of several species have been found in New Zealand (Pleistocene)—has not been my good fortune up to the present.

Taking *Cereopsis* into consideration, my views at present upon the taxonomy of the *Anseres* may be set forth as follows :—

SUB-ORDER.	FAMILIES.	SUB-FAMILIES.
Anseres.	Anatidæ	1. Cygninæ
		2. Anseranatinæ
		3. Plectropterinæ
		4. Cereopsinæ
		5. Anserinæ
		6. Dendrocygninæ
		7. Chenonettinæ
		8. Anatinæ
		9. Fuligulinæ
		10. Erismaturinæ
		11. Merganettinæ
		12. Merginæ
	Gastornithidæ (extinct ; provisional)	Not determined.

Recently, I have completed a contribution on the genus *Dendrocygna*, examining the members of the entire genus and two species osteologically. My examination of them has led me to believe that they represent a distinct sub-family of themselves, and this sub-family I have duly characterized in the aforesaid work, which will appear in due course.

EXPLANATION OF PLATES.

(All the plates are from photographs made direct from the specimens by the author.)

PLATE XXVIII.

Fig. 1.—Right lateral view of the skull of *Cereopsis novæ-hollandiæ* with mandible detached. Very slightly reduced. (No. 19,711, Coll. U.S. Nat. Mus.)

Fig. 2.—Right lateral view of the skull of *Dendrocygna autumnalis*, ♀, with mandible detached. Very slightly reduced. Collected in Southern Texas by Mr. F. B. Armstrong. Note the complete osseous periphery to the orbit.

Fig. 3.—Right lateral view of the skull of *Hymenolæmus malacorhynchus*, ♀ (New Zealand). (No. 19,024, Coll. U.S. Nat. Mus.) Mandible detached. Very slightly reduced.

Fig. 4.—Right lateral view of the skull and detached mandible of *Chloëphaga poliocephala*, ♀ (Strait of Magellan). (No. 18,202, Coll. U.S. Nat. Mus.)

PLATE XXIX.

Fig. 5.—Dorsal aspect of pelvis of *Chenonetta jubata*. All the bones on this plate belonged to the same individual, and are natural size. (No. 19,213, Coll. U.S. Nat. Mus.) It will be observed that the pelvis is broken and incomplete, as the specimen is sub-fossil, and was found in a cave in New Zealand (Otago).

Fig. 6.—Left scapula, dorsal view, *Chenonetta jubata*. Same individual as described under fig. 5.

Fig. 7.—Anterior aspect of the *os furculum*, *Chenonetta jubata*. Same individual as described under fig. 5.

Fig. 8.—Anterior aspect of left *coracoid*, *Chenonetta jubata*. Same individual as described under fig. 5 of this plate.

Fig. 9.—Anterior aspect of left *tarso-metatarsus*, *Chenonetta jubata*. Same individual as described under fig. 5. (No. 19,213, Coll. U.S. Nat. Mus.)

Fig. 10.—Inner or anconal aspect of the right *carpo-metacarpus*, *Chenonetta jubata*, referred to under fig. 5 of this plate.

Fig. 11.—Left *femur*, anterior aspect, *Chenonetta jubata*. See description under fig. 5 of this plate.

Fig. 12.—Superior view of the *skull* of *Chenonetta jubata*. (No. 19,213, Coll. U.S. Nat. Mus.) Broken and imperfect. See account given under fig. 5 (*antea*).

Fig. 13.—Inner or anconal aspect of right *humerus* of *Chenonetta jubata*. See fig. 5 of this plate for further description.

Fig. 14.—Direct ventral aspect of the *sternum* of *Chenonetta jubata*. Same skeleton as shown in the other figures of this plate.

PLATE XXX.

Fig. 15.—Nearly direct dorsal aspect of the *trunk skeleton* and *shoulder girdle* of *Cereopsis novæ-hollandiæ*, considerably reduced. What is here shown in the figure measures in the skeleton, mid-longitudinally, from the apex of the pygostyle to the most anterior point on the cervical vertebra, 29.3 cms. In the figure, the same line measures 18.3 cms. Figures of the skull of this individual are shown in fig. 1, Plate XXVIII., fig. 18 of the present plate, and fig. 19, Plate XXXI. (No. 19,711, Coll. U.S. Nat. Mus.) For a lateral view of this trunk skeleton, see fig. 25 of Plate XXXIII.

Fig. 16.—Direct dorsal view of the *trunk skeleton* and *shoulder girdle* of *Hymenolæmus malacorhynchus*, ♀. (No. 19,024, Coll. U.S. Nat. Mus.) This trunk skeleton is reduced in the same proportion as that of *Cereopsis* shown in fig. 15 of this plate. (Collected by A. Reischek, Paringa, Westland, New Zealand.) The lateral view of this trunk skeleton is given in fig. 26 of Plate XXXIV., and the shoulder of the same individual in fig. 17 of this plate, fig. 3 of Plate XXVIII., fig. 20 of Plate XXXI. See also fig. 21 of Plate XXXI. for the *humerus*.

Fig. 17.—Skull of *Hymenolæmus malacorhynchus*, ♀, from the same skeleton as the one referred to under fig. 16 of this plate. Natural size.

PLATE XXIX.

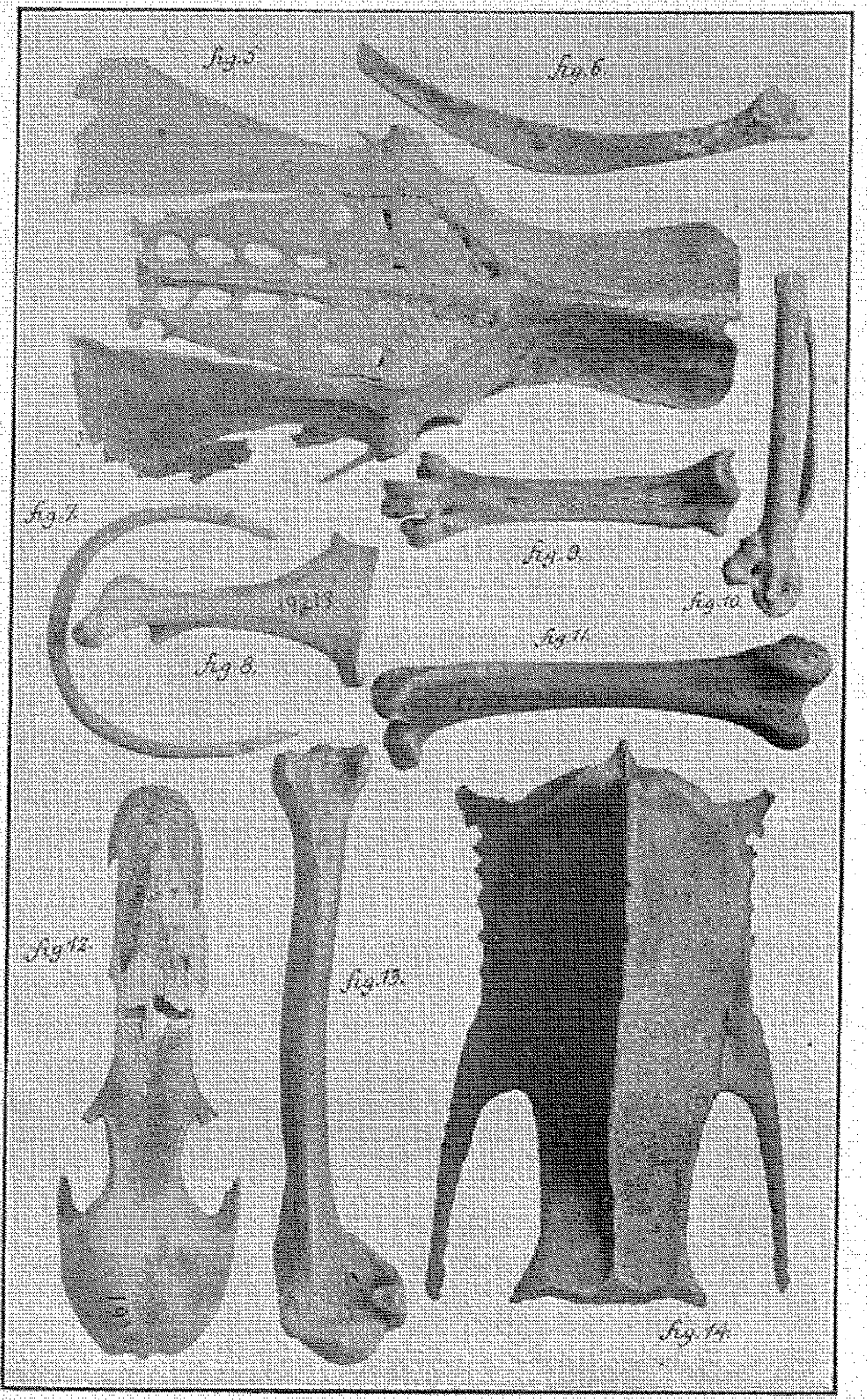

PLATE XXX.

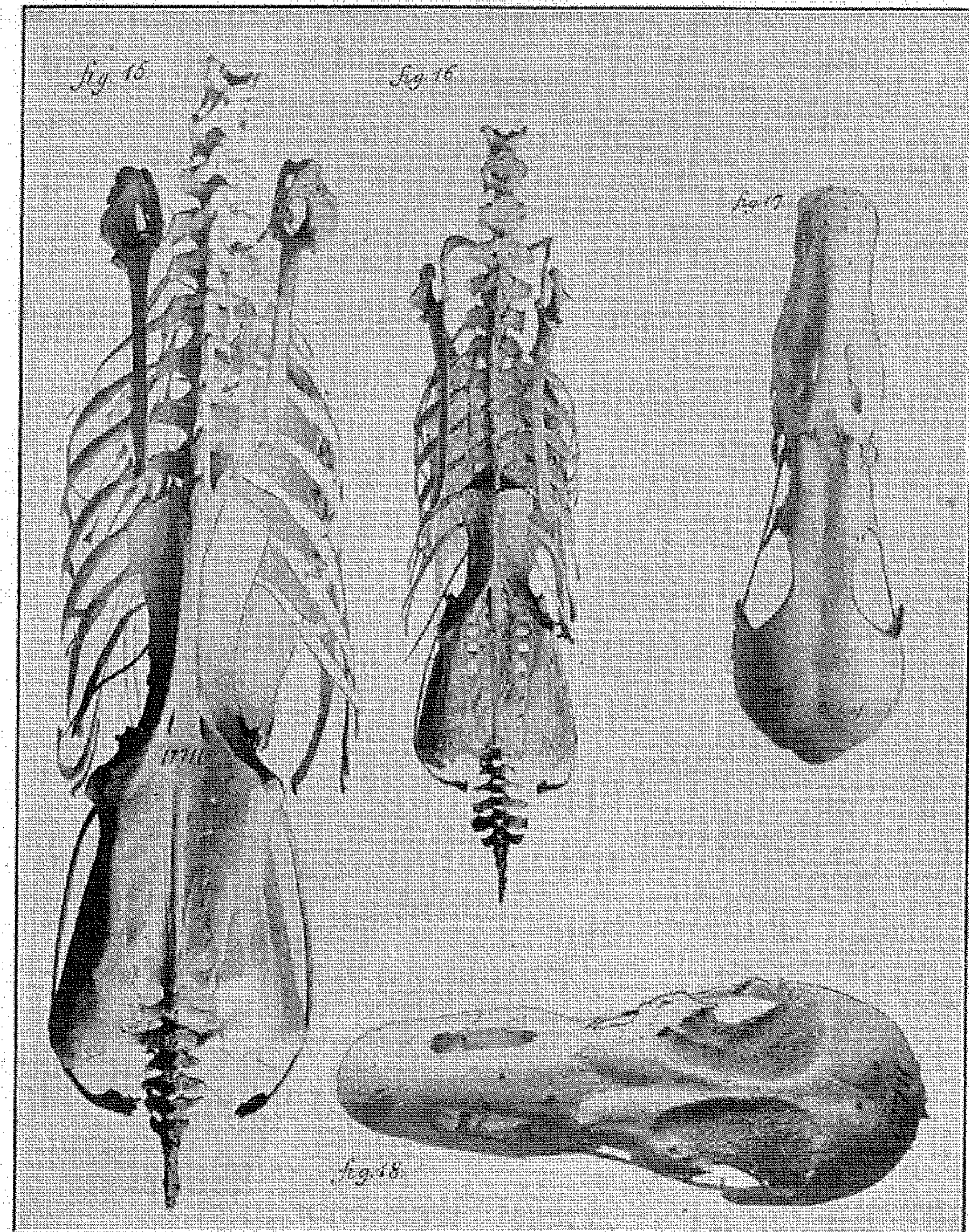

PLATE XXXI.

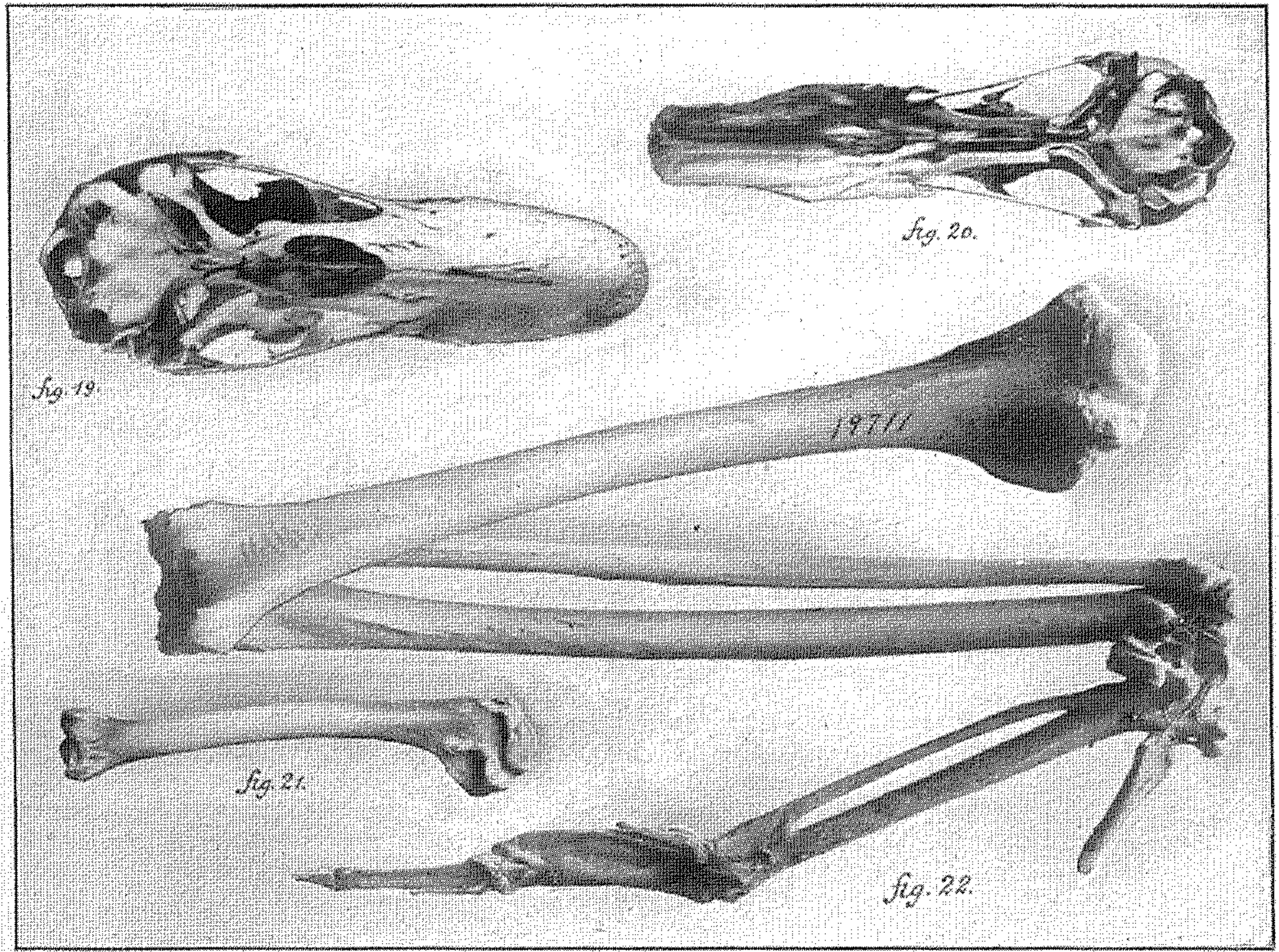

PLATE XXXII.

fig. 23.

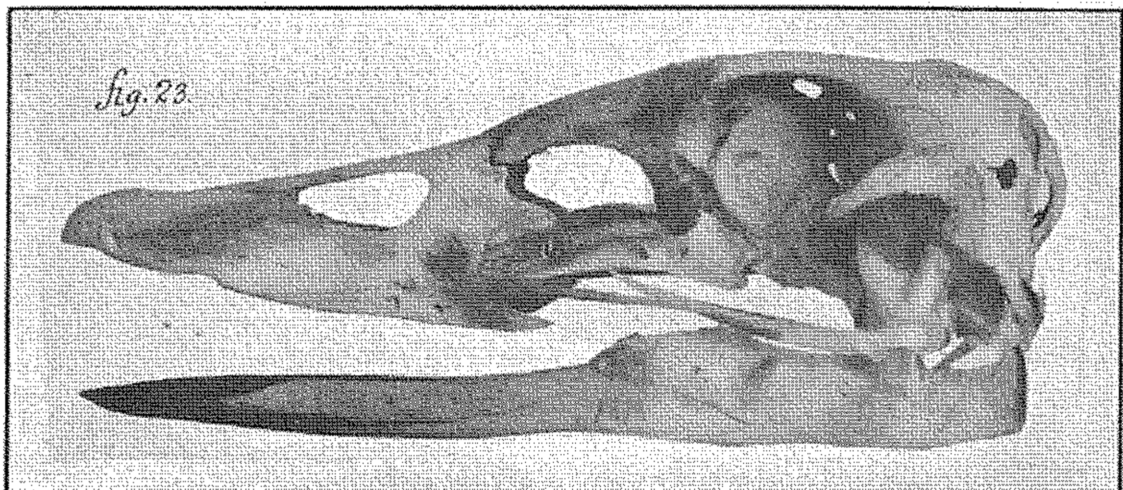

fig. 24.

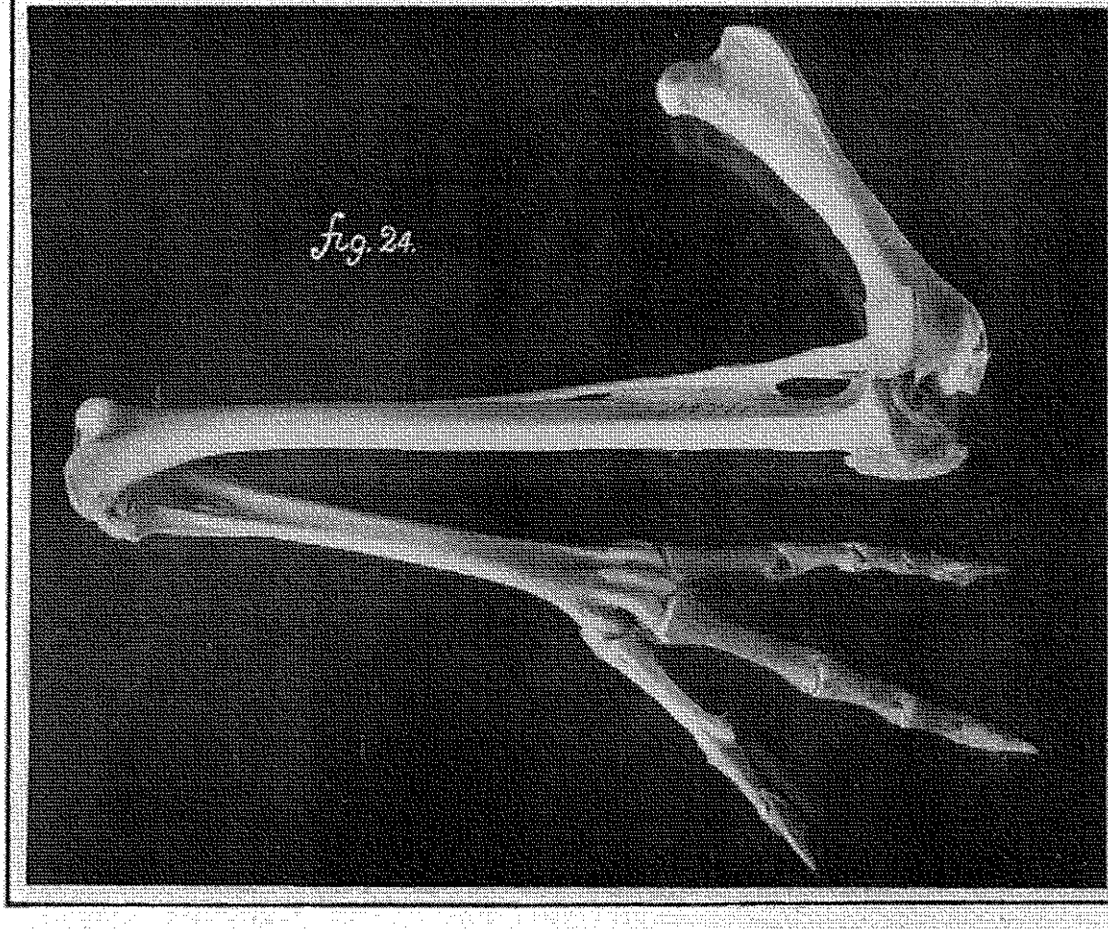

PLATE XXXIII.

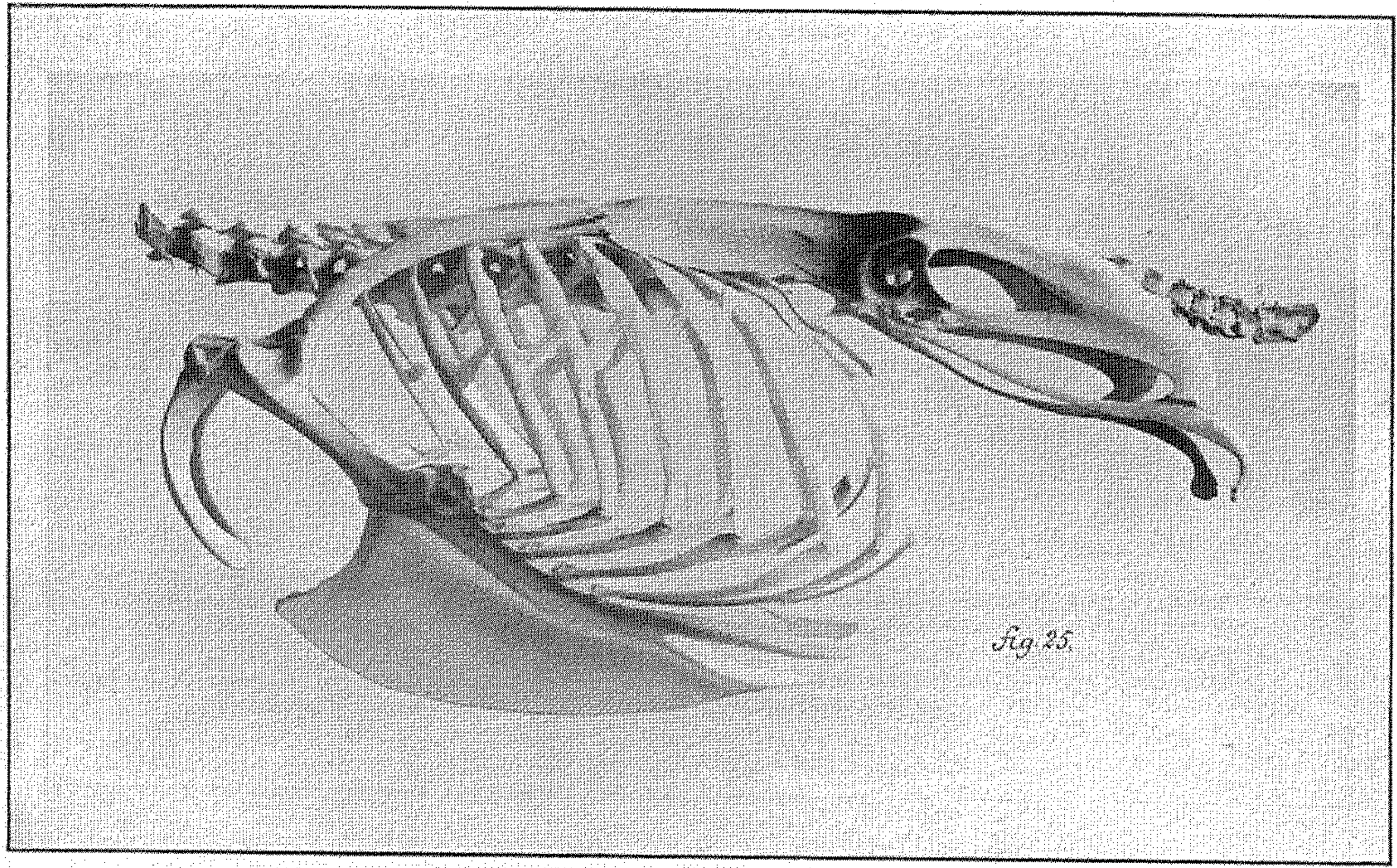

Fig. 25.

PLATE XXXIV.

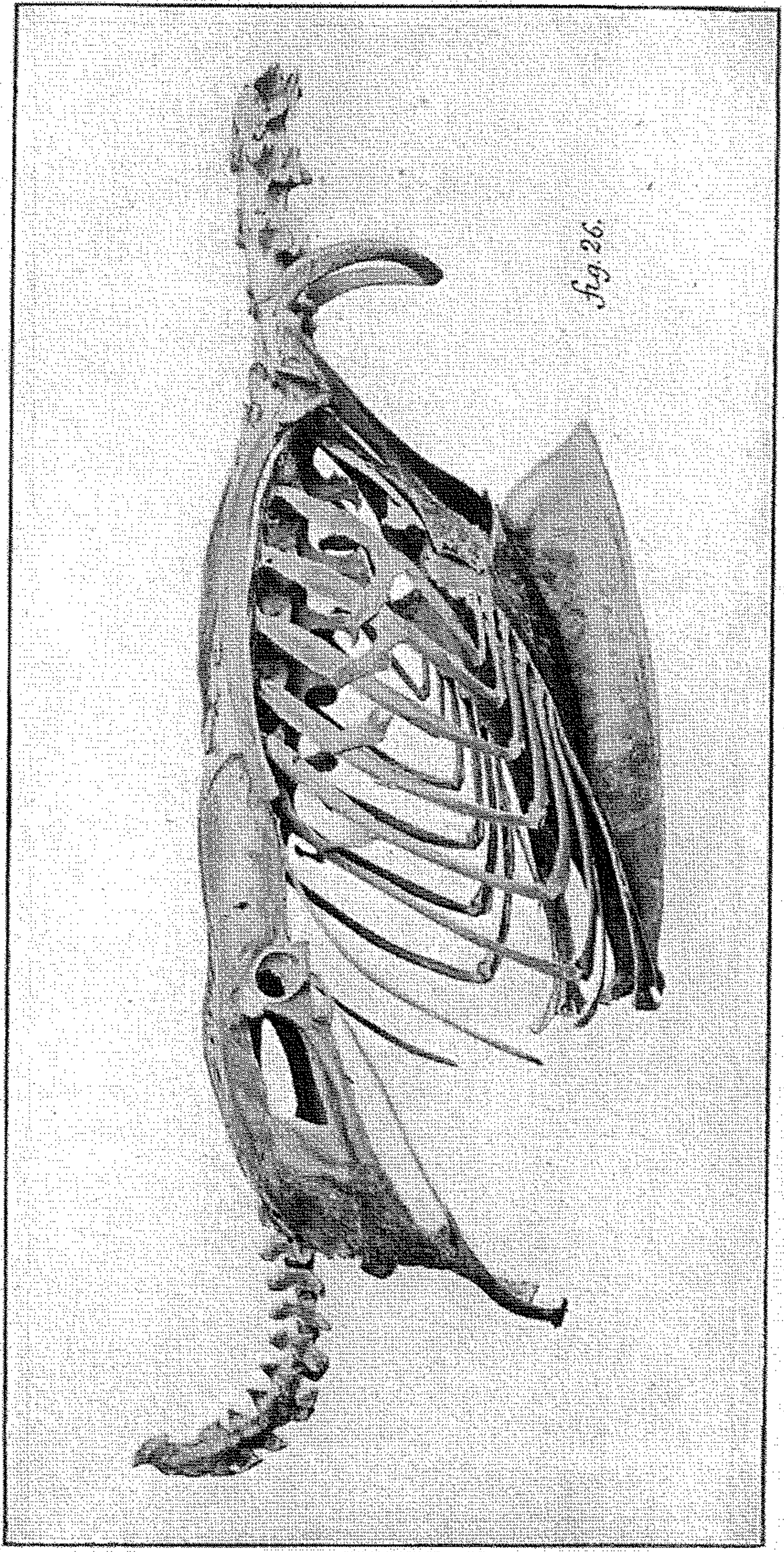

fig. 26.

Fig. 18. — Superior view of the skull of *Cereopsis novæ-hollandiæ*. From same skeleton as other figures shown on the plates. Natural size. (See fig. 1, Plate XXVIII., fig. 19, Plate XXXI.)

PLATE XXXI.

Fig. 19.—Basal view of the skull of *Cereopsis novæ-hollandiæ*. Slightly reduced. (Same skull as shown in other figures: Plate XXVIII., fig. 1, Plate XXX., fig. 18). Mandible removed.

Fig. 20.—Basal view of the skull of *Hymenolæmus malacorhynchus*. Slightly reduced; mandible removed. Same skull as shown in other figures: Plate XXVIII., fig. 3, Plate XXX., fig. 17.

Fig. 21.—Direct anconal aspect of the left *humerus* of *Hymenolæmus malacorhynchus*. Slightly reduced; actual length of this bone in the skeleton is 8.1 cms. From the same individual as furnished other bones and the skull on the plates. (No. 19,024, Coll. U.S. Nat. Mus.)

Fig. 22.—Anconal aspect of the left *pectoral limb* of *Cereopsis novæ-hollandiæ*. From the skeleton of the same individual as shown on the other plates. (No. 19,711, Coll. U.S. Nat. Mus.) Slightly reduced; the actual length of the humerus in the skeleton is 16.8 cms., it being but 15.2 cms. in the figure.

PLATE XXXII.

Fig. 23.—Left lateral aspect of the skull, including lower mandible, of *Tachyeres cinereus*. (No. 1,818, Coll. U.S. Nat. Mus.) Natural size. Collected by Dr. Tolmie on the Falkland Islands. A shot-hole is seen in the occipital region, between the squamosal process and the left supra-occipital foramen. The bones at the middle third of the zygoma are partially disarticulated. The *vomer* is seen arching above the palatines, and the interorbital plate is entire.

Fig. 24.—Left *pectoral limb* of *Cereopsis novæ-hollandiæ*, from the skeleton of the same individual as shown in other plates. (No. 19,711, Coll. U.S. Nat. Mus.) The femur is shown antero-laterally; the *tibio-tarsus* on almost direct inner aspect, as is also the *fibula*. The *tarso-metatarsus* and the bones of *pes* are seen on almost direct dorsal view. Much reduced. The extreme length of the *tibio-tarsus* in the skeleton measures from apex of cnemial process to most distant point on inner condyle, 16.4 cms., and the basal joint of mid-toe has a length of 3.1 cms. in the skeleton of this foot.

PLATE XXXIII.

Fig. 25.—Left lateral view of the *trunk skeleton* and *shoulder girdle* of *Cereopsis novæ-hollandiæ*. (No. 19,711, Coll. U.S. Nat. Mus.) Very considerably reduced. For actual measurements see description of fig. 15 of Plate XXX.

PLATE XXXIV.

Fig. 26.—Right lateral aspect of the *trunk skeleton* and *shoulder girdle* of *Hymenolæmus malacorhynchus*. (No. 19,024, Coll. U.S. Nat. Mus.) Very considerably reduced. For actual measurements see description of fig. 16, Plate XXX.